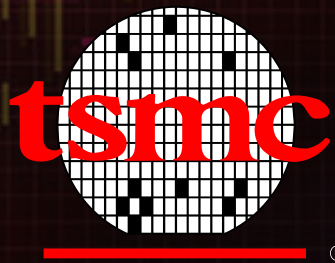


Enabling Reliability, Quality and Safety within Automotive Design Platform

Synopsys



TSMC 2016
Open Innovation Platform®
Ecosystem Forum

ABSTRACT

Automakers (OEMs) worldwide are on an aggressive path to change the way we think of and use our cars - whether driven by ourselves, or left to an autonomous “smart” system get us to our destination. Their emerging strategy is to design smart, secure, and safe connected cars. These cars will utilize high-performance embedded compute engines, advanced sensors and wireless communications systems to enable vehicles to “see” and “interact” with nearby vehicles and infrastructure, to guide a safe, efficient and comfortable path on the road. As a result, there is an increasing demand for safety-critical electronic systems, collectively known as advanced driver assistance systems, or ADAS. To satisfy their OEM customers, Tier 1 and semiconductor suppliers must develop ADAS SoCs that incorporate the latest multimedia and communications standards, and run multiple embedded software algorithms to combine image and radar system sensor data and to enable smart actuation of appropriate vehicle safety and navigation systems.

These trends present additional challenges for automotive IC designers to meet higher performance and power efficiency goals, along with legacy demands for in-vehicle robustness and reliability, time-to-market and cost effectiveness. As advanced ICs are being deployed in safety-critical automotive systems, designers must also pay attention to functional safety and quality standards, such as ISO 26262 and AEC Q100, to minimize the risk of systematic and random failures that might cause injury or high costs of a vehicle recall.

In this session, the presenter will introduce the challenges facing designers of high-reliability digital and analog/mixed-signal ICs for the automotive market, and outline an automotive design platform, consisting of proven EDA and IP solutions being deployed by design teams worldwide with TSMC’s automotive application-specific technologies, including 16FFC.

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Silicon to Software



Enabling Reliability, Quality and Safety within Automotive Design Platform

Steve Smith
Senior Director of Marketing, Automotive Solutions
Semiconductor Automotive Functional Safety Professional (SGS-TÜV Saar)

TSMC OIP, San Jose, CA
September 22nd, 2016

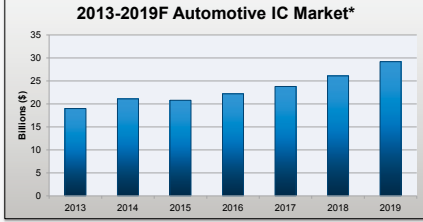


Market Growth for Automotive SoCs

Advanced Driver Assistance Systems (ADAS) and Infotainment

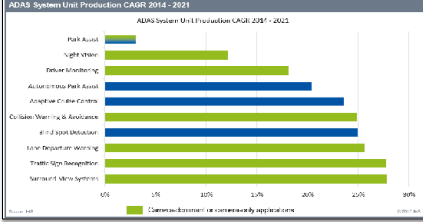
- Automotive IC market: \$20.8B in 2015*
- 6.7% annual growth from 2014 to 2019*
- ADAS: Fastest growing application: 25% annual growth 2014 to 2021**

2013-2019F Automotive IC Market*



Year	Market Size (\$B)
2013	18.5
2014	20.0
2015	20.8
2016	22.0
2017	23.5
2018	25.5
2019	27.5
2019F	29.5

ADAS System Unit Production CAGR 2014-2021



Application	CAGR (%)
Full ADAS	~10
Night Vision	~12
Blind Spot Detection	~15
Adaptive Cruise Control	~18
Autonomous Parking Assist	~20
Collision Warning & Avoidance	~22
Forward Collision Detection	~23
Lane Departure Warning	~24
Traffic Sign Recognition	~25
Surround View Systems	~25

Growth Drivers

- Communication & entertainment convergence
- Green initiatives: Energy savings & reduced emissions
- Active safety & telematics

Source: *IC Market Drivers, IC Insights, January 2016 & **Trends and Opportunities in Driver Assistance and Automated Driving, IHS Automotive Sep 2015

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Critical Challenges for Automotive Grade Design

Functional Safety

Completing ISO 26262 functional safety assessments to ensure target Automotive Safety Integrity Levels (ASILs) achieved

Reliability

Reducing risk & development time for highly robust and reliable automotive ICs

Quality

Meeting target quality levels required for automotive applications

Collaboration between Synopsys & TSMC for Automotive Grade Design Flow and IP in compliance with functional safety, reliability and quality standards

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Synopsys Automotive Focus

Software

Verification (SW)

Design (HW)

IP



Smart, Secure, and Safe



Infotainment

V2V Comms.

ADAS

Autonomous

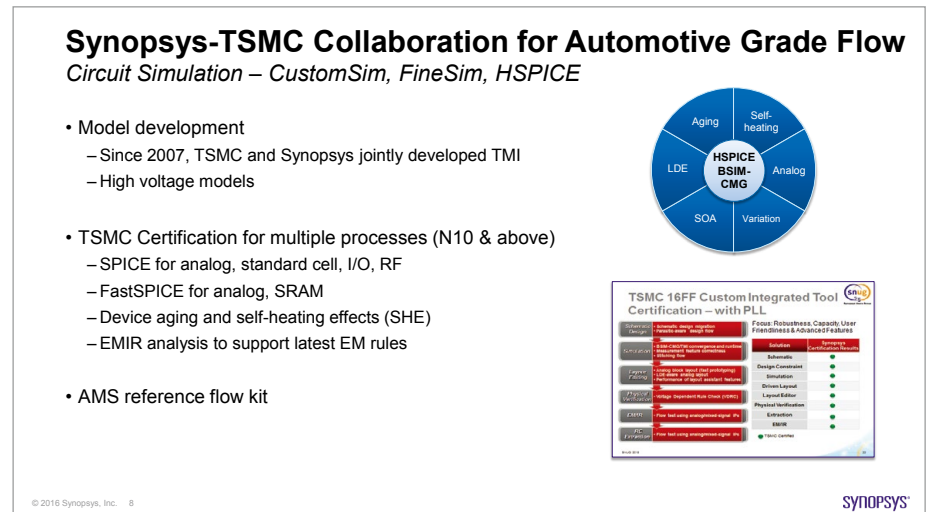
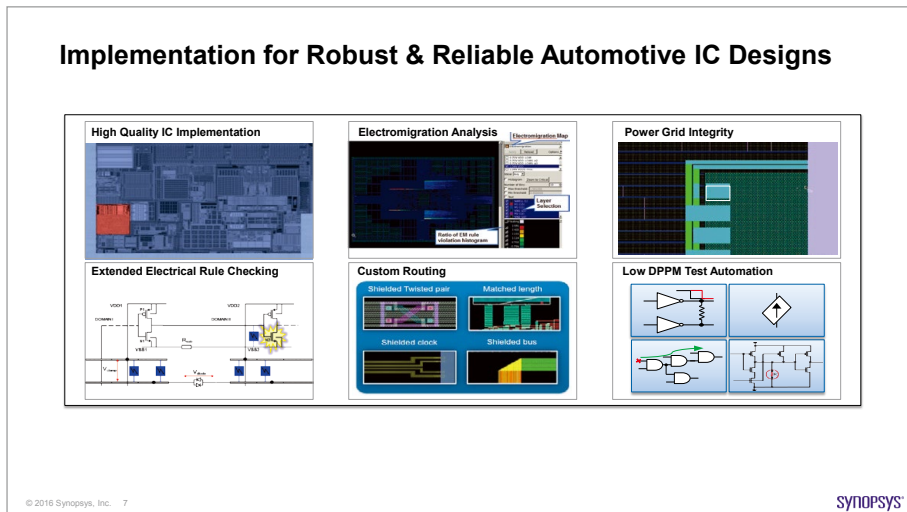
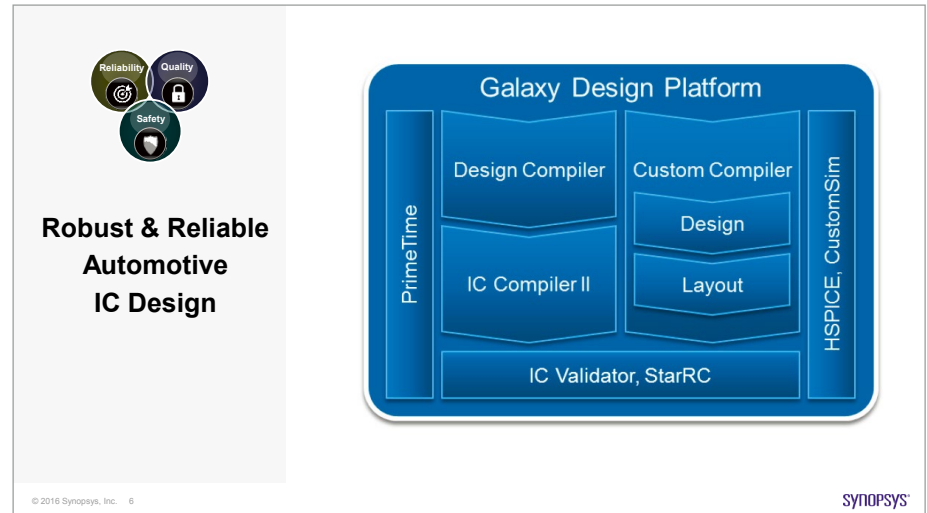
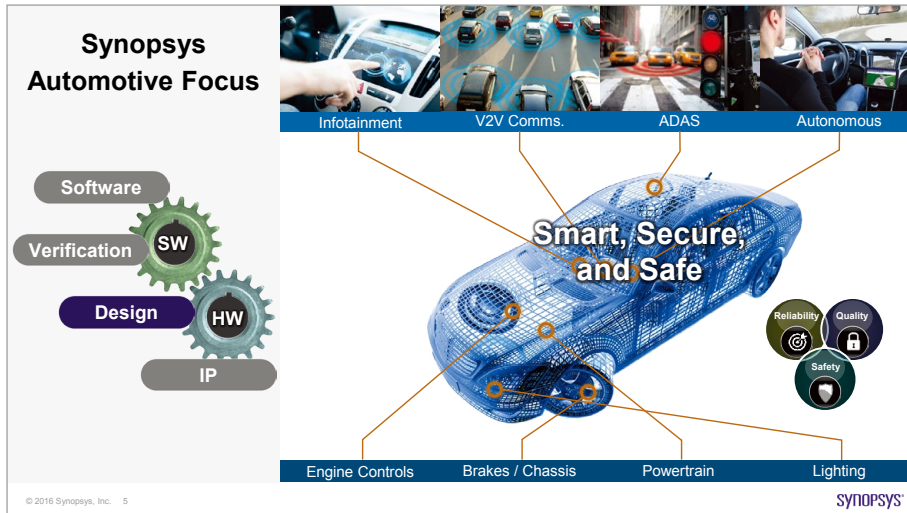
Engine Controls

Brakes / Chassis

Powertrain

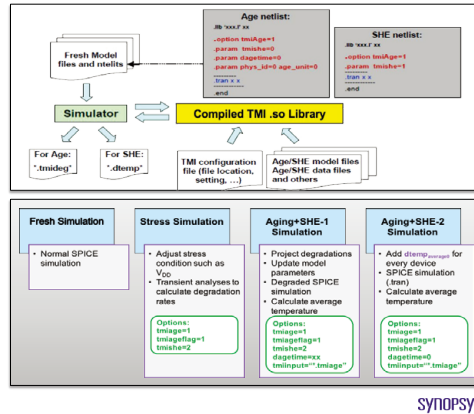
Lighting

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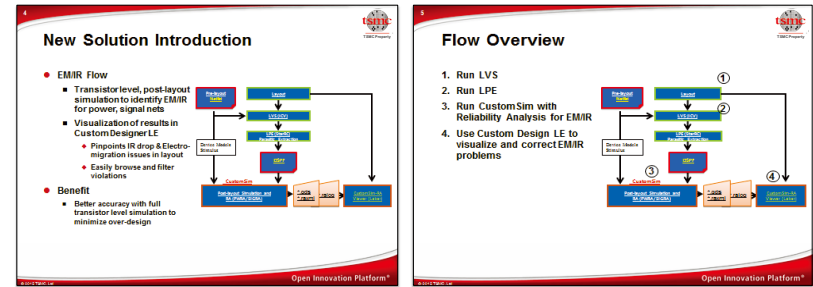
Synopsys-TSMC Collaboration for Automotive Grade Flow FinFET Self-Heating and Aging Simulation Flow

- Self-Heating Effect (SHE) on Hot-Carrier Injection (HCI) and Bias-Temperature Instability (BTI)
- More prominent in FinFET technologies
- Accelerates device aging, affecting circuit characteristics and reliability lifespan
- TMI enables efficient self-heating and aging modeling and simulation
- Perform four aging simulations in one shot



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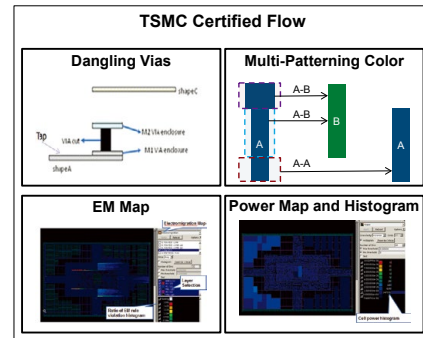
Synopsys-TSMC Collaboration for Automotive Grade Flow TSMC 16/10nm Reference Flow



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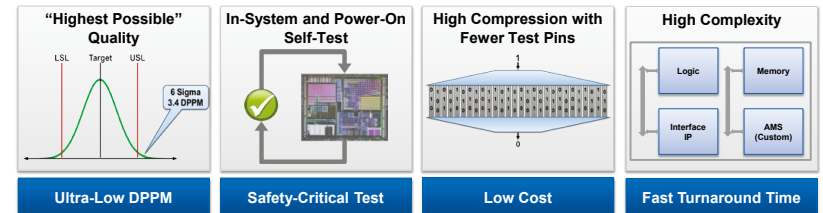
Synopsys-TSMC Collaboration for Automotive Grade Flow EM / IR Analysis – PrimeRail Certified by TSMC for N10 and Above

- TSMC certified for N10 and above for
 - EM rules: DC average, AC RMS (self-heating, aging)
 - Static IR accuracy
 - Dynamic IR accuracy
- TSMC N10 EM rule coverage to accurately identify violation location
 - Length dependent rules
 - Via to via spacing rules
 - Via to metal coverage rules
 - Current direction dependent rules
 - Color-aware EM rules



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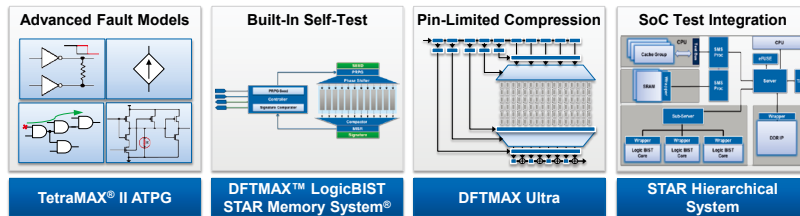
Test Challenges for Automotive ICs



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High Quality with Low DPPM

Synthesis-based Automotive IC Test Solution



Higher Quality and Safety — with Lower Cost and Faster Turnaround Time

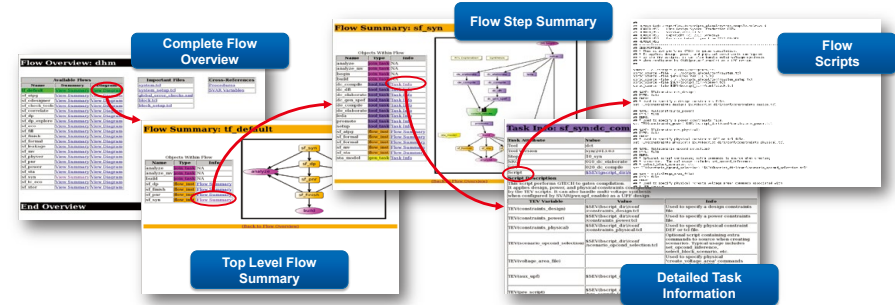
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Design Flow Automation and Documentation for ISO 26262

Lynx Auto Docs

- Automatically generates complete HTML hyperlinked flow doc set
- Simple and easy documentation for flow configurations and changes

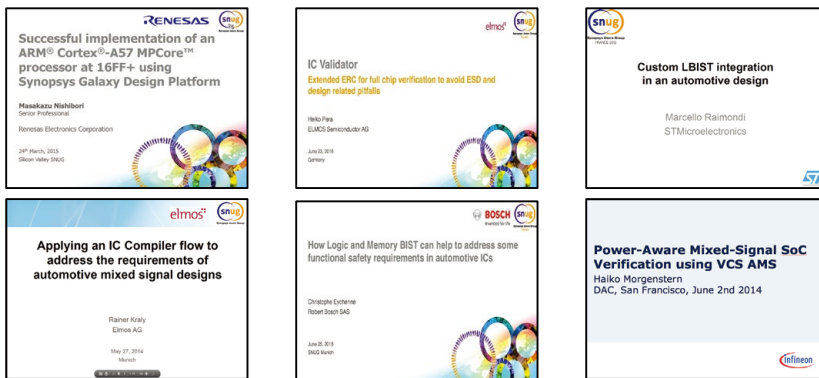


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Implementation for Robust & Reliable Automotive IC Designs

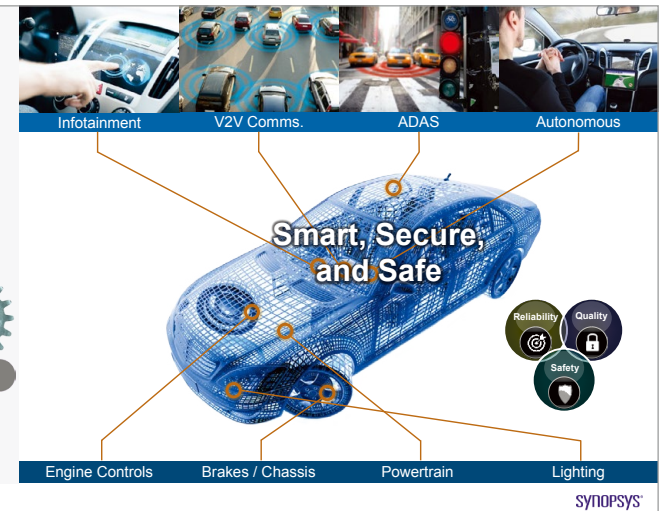
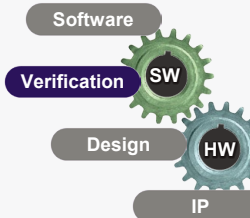
Customer Design Examples



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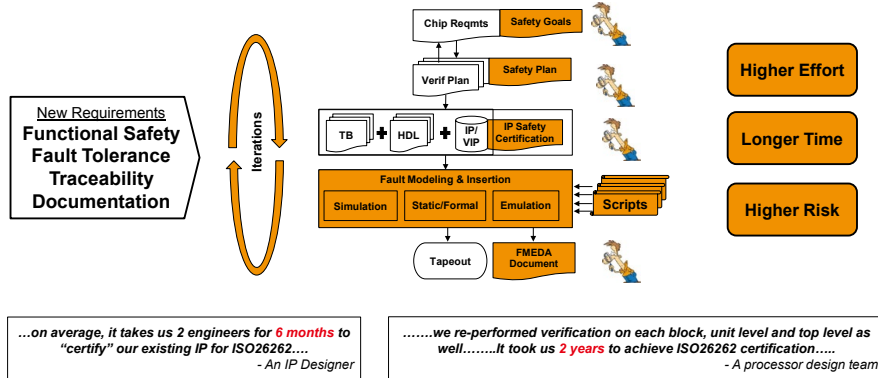
Synopsys Automotive Focus



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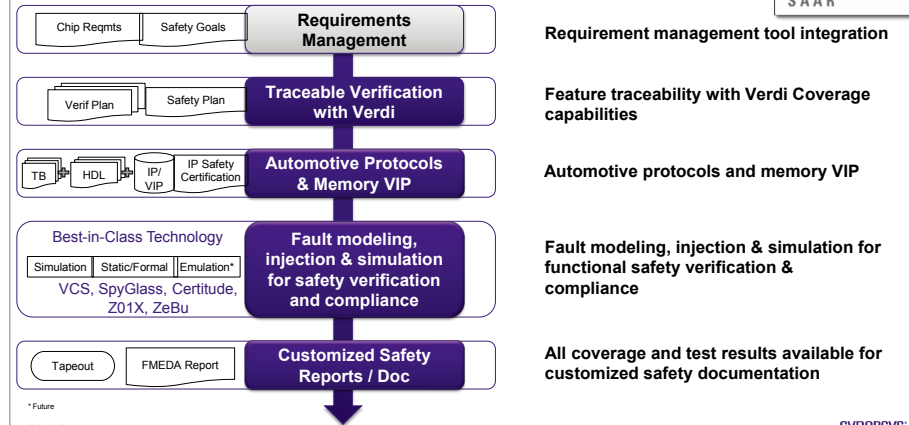
Impact of Safety Verification for ISO 26262 Compliance



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Synopsys Functional Safety Verification Solution



* Future

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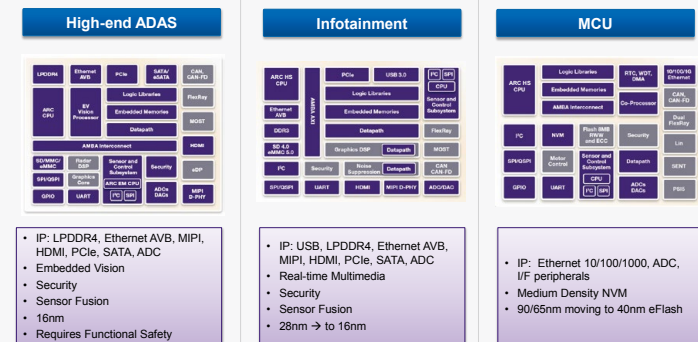
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Automotive Applications Require Different SoC Architectures



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DesignWare IP for Automotive ADAS and Infotainment Applications for TSMC 16nm FinFET Process

Accelerates Qualification of Automotive SoCs

PHY IP for 16FF+/FFC		Controller IP	
PCI Express	USB	Ethernet AVB	LPDDR4
LPDDR4	NVM	MIPI CSI-2/DSI	PCI Express
HDMI	MIPI D-PHY	HDMI	Mobile Storage
Embedded Memories	Logic Libraries	ARC EM Processors	EV Vision Processors
	Data Converters	Security: Encryption & Decryption	Sensor & Control IP Subsystem

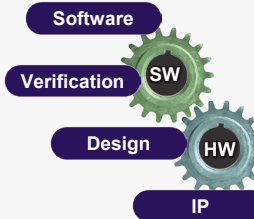
- **ISO 26262 ASIL Ready IP** enables faster Functional Safety Certification of Automotive SoCs
- Qualification of Automotive Grade IP with **AEC-Q100 stress testing**
- Significant investments in **TS 16949 quality management**



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Automotive Grade Design Flow



Summary

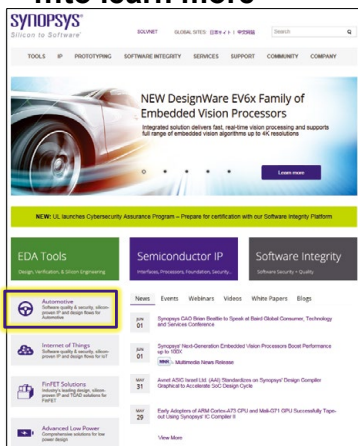
- **Robust** and **reliable** design implementation
- ISO 26262 certified test solution for higher **quality**
- Comprehensive functional **safety** verification solution
- ASIL ready IP to accelerate path to ISO 26262 compliance
- Support for TSMC technologies including 16FFC
- Close TSMC partnership enables automotive SoC success



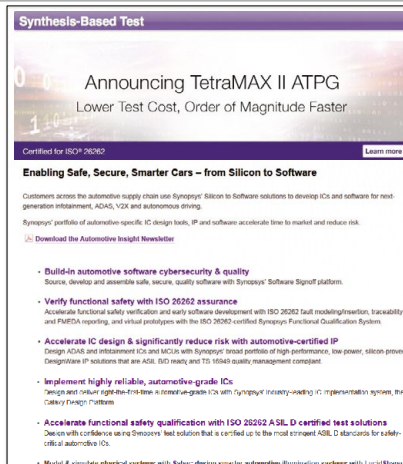
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...to learn more



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